

REMARKS

I. Present Status of the Application

The Office Action rejected claims 11, 19-21 and 32 under 35 U.S.C. § 112, ¶ 2, as being indefinite. The Office Action also rejected, under 35 U.S.C. § 102(a), claims 1-4, 10-14, 17, 22-27 and 30 as being anticipated by Akram (US 5,903,058), and claims 33-36 as being anticipated by Chakraworty (US 6,181,569). The Office Action further rejected, under 35 U.S.C. § 103(a), claims 5, 7, 18, 19, 23, 31 and 32 as being unpatentable over Akram as applied to claims 1, 10 and 22, further in view of Kimijima et al. (JP 08-213399), claims 6, 8-9, 15-16, 20-21 and 28-29 as being unpatentable over Akram as applied to claims 1, 10 and 22, further in view of Chakravorty and Hosaka (US 6,475,897), and claims 37 and 38 as being unpatentable over Chakravorty as applied to claim 33, and further in view of Hosaka.

Upon entry of the amendments in this response, claims 1, 10, 11, 20, 22, 33 and 36 are amended, and claims 7, 19, 32 and 35 are canceled. Hence, claims 1-6, 8-18, 20-31, 33, 34 and 36-38 are now pending in the present application. Claims 1, 10 and 22 are amended by incorporating the limitation cited in the original claims 33, claims 1, 10, 22 and 33 are also amended by incorporating limitations cited in the original claims 7, 19, 32 and 35, respectively. Further, claim 11 is amended to clear up matter of form. Applicants believe that the foregoing amendments do not introduce new matter. Thus, reconsideration of those claims is respectfully requested.

II. Response to Objections and Rejections

A. Rejections under 35 U.S.C. 112, ¶ 2

The Office Action, at page 2, item 1, rejected claims 11, 19-21 and 32 under 35 U.S.C. § 112, ¶ 2, as being indefinite. Applicants have made changes in claims 11, and considered the changes when incorporating the limitations of claims 19, 20 and 32 into their respective independent claims, in accordance with the Examiner's requests. Applicants therefore respectfully submit that the grounds of rejections have been addressed and the rejections overcome. Reconsideration and withdrawal of the rejections are respectfully requested.

B. Rejections under 35 U.S.C. § 102(b)

1. Rejection under 35 U.S.C. § 102(b) over Akram

The Office Action, at page 3, item 2, rejected claims 1-4, 10-14, 17, 22-27 and 30 under 35 U.S.C. § 102(b) as being anticipated by Akram. Applicants respectfully traverse the rejection as it applies to the amended claims for at least the reasons set forth below.

To anticipate a claim, the prior art reference must teach each and every element of the claim. M.P.E.P. § 2131.

The presently claimed invention is not anticipated by Akram. The independent claims 1, 10 and 22, as amended, are directed to methods of forming a bump on a wafer including a step of bonding a conductive stud onto the wettable layer (or UBM) "by wiring bonding." The use of wiring bonding is effective, for example, to form a bump with very small pitch as explained in the specification.

Akram, however, does not teach the step of bonding the conductive stud "by wiring bonding" while describing the formation of a solder bump on the UBM pad (Fig. 1h; column 2, lines 47-57). Thus, Akram does not anticipate claims 1, 10 and 22 of the invention. Consequently, other rejected claims that dependent on claim 1, 10 or 22 are also not anticipated by Akram based on the dependency as a matter of law.

Accordingly, for at least the foregoing reasons, Applicants respectfully submit that the grounds of rejection have been addressed and the rejection has been overcome. Reconsideration and withdrawal of the rejection are respectfully requested.

2. Rejection under 35 U.S.C. § 102(b) over Chakraworty

The Office Action, at page 5, item 3, rejected claims 33-36 under 35 U.S.C. § 102(b) as being anticipated by Chakraworty. Applicants respectfully traverse the rejection as applied to the amended claims for at least the reasons set forth below.

The independent claim 33, as amended, recites as follows.

33. A method of forming a bump on a UBM that has been formed on an active surface of a wafer, the method comprising:

bonding a conductive stud on the UBM by wire bonding; and
flattening the conductive stud after the conductive stud is bonded onto
the UBM.

(Emphasis added). Apparently, a flattening step is required after the conductive stud is bonded onto the UBM.

Chakaravorty is directed to a process wherein a metal bump is deposited over the UBM selectively (column 8, line 57-58; Figs. 5 and 5a), and then the UBM is partially removed by etching process (column 8, lines 64-66; Figs. 5 and 5a). Chakaravorty, however, does not teach the flattening step as recited in the claims of the invention but merely discloses a “mechanically polishing” process (column 11, 1-6).

Therefore, Chakraworty does not anticipate claim 33, as amended, since Chakraworty does not disclose each and every element of the claim. Consequently, Chakraworty also does not anticipate claims 34-36 dependent on claim 33 as a matter of law.

For at least the foregoing reasons, Applicants respectfully submit that the grounds of rejection have been addressed and the rejection overcome. Reconsideration and withdrawal of the rejection is respectfully requested.

C. Rejections under 35 U.S.C. § 103(a)

1. Rejections under 35 U.S.C. § 103(a) over Akram in view of Kimijima et al.

The Office Action, at pages 6, item 4, rejected claims 5, 7, 18, 19, 23, 31 and 32 under 35 U.S.C. § 103(a) as being unpatentable over Akram as applied to claims 1, 10 and 22, further in view of Kimijima et al. Applicants respectfully traverse the rejection as applied to the amended claims for at least the reasons set forth below.

As discussed in the foregoing subsection II.B.1, Akram failed to teach the requisite step of bonding a conductive stud “by wiring bonding.” Moreover, as stated by the Examiner, Akram also “failed to teach the top surface of the conductive stud is flattened by polishing before reflow” (Office Action, at page 7, paragraph 3, lines 4-5). Thus, as a whole, the invention recited in the independent claims 1, 10 and 22, and the claims 5, 7, 18, 19, 23, 31 and 32 dependent thereupon is significantly different from the method of Akram.

On the other hand, Kimijima, does not teach or suggest the process of wiring bonding, though teaching flattening step. Therefore, as a whole, there is no teaching or suggestion to combine the teachings of Akram and Kimijima, and even if there were a combination, the mere combination would not have created the claimed invention.

Therefore, the rejected claims are not rendered obvious over Akram in view of Kimijima, Accordingly, for at least the foregoing reasons, Applicants respectfully submit that the grounds of rejection have been addressed and the rejection has been overcome. Reconsideration and withdrawal of the rejection are respectfully requested.

2. Rejections under 35 U.S.C. § 103(a) over Akram in view of Chakravorty and Hosaka

The Office Action, at page 8, item 5, rejected claims 6, 8-9, 15-16, 20-21 and 28-29 under 35 U.S.C. § 103(a) as being unpatentable over Akram as applied to claims 1, 10 and 22, further in view of Chakravorty and Hosaka. Applicants respectfully traverse the rejection as it applies to the amended claims for at least the reasons set forth below.

As discussed in the foregoing subsections II.B.1 and II.C.1, Akram failed to teach the requisite step of bonding a conductive stud “by wiring bonding,” and “failed to teach the top surface of the conductive stud is flattened by polishing” (Office Action, at page 7, paragraph 3, lines 4-5). Thus, the invention recited in the independent claims 1, 10 and 22, and the claims 6,

8-9, 15-16, 20-21 and 28-29 dependent thereupon is significantly different from the method of Akram.

Chakraworty, on the other hand, does not teach or suggest the flattening process as recited in the independent claims 1, 10 and 22, and moreover, and does not teach at least two steps recited in the amended claims 1 and 10: a step of forming a photomask on the UBM, and a subsequent step of partially removing the UBM not covered by the photomask, before the conductive stud is bond on the UBM by wire bonding. Thus, due to these significant differences, Applicants respectfully disagree with the Examiner's statement that "Chakravorty teaches using wire bonding is the equivalent technique to the bonding technique of Akram. Therefore, even if Hasaka, teaches the wire bonding technology (note also without the flattening process), as viewed in a whole, none of the cited prior art references teach, suggest or motivate the combination, and even if there were a combination, the mere combination would not have created the claimed invention.

Therefore, the rejected claims are not rendered obvious over the cited prior art references, Accordingly, for at least the foregoing reasons, Applicants respectfully submit that the grounds of rejection have been addressed and the rejection has been overcome. Reconsideration and withdrawal of the rejection are respectfully requested.

3. Rejections under 35 U.S.C. § 103(a) over Chakravorty in view of Hosaka

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The Office Action, at page 10, item 6, rejected claims 37 and 38 as being unpatentable over Chakravorty as applied to claim 33, and further in view of Hosaka. The Examiner states that it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate Hosaka's teaching of wire bonding and ultrasonic wave in the process of Chakravorty. Applicants respectfully traverse the rejection.

Similarly as discussed in the foregoing subsections II.B.2 and II.C.2, Chakravorty does not teach the flattening step as recited in the independent claim 33. Similarly also as discussed in the foregoing subsection II.C.2, Hosaka does not teach the flattening step. The claims 37 and 38 inherit the element of the flattening step from claim 33. Because of the aforementioned reasons, even if there were a combination of Chakravorty and Hosaka, the combination would not have created the claimed invention.

Therefore, claim 37 or 38 is non-obvious over Chakravorty as applied to claim 33, and further in view of Hosaka. Accordingly, for at least the foregoing reasons, Applicants respectfully submit that the grounds of rejection have been addressed and the rejection overcome. Reconsideration and withdrawal of the rejection are respectfully requested.

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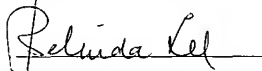
CONCLUSION

For at least the foregoing reasons, it is believed that the pending claims 1-6, 8-18, 20-31, 33, 34 and 36-38 are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

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Respectfully submitted,



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